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Comparison of laparoscopic versus open Burch colposuspension techniques for female stress or mixed urinary incontinence: a ten-year experience in a tertiary center

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ABSTRACT

Aims: To evaluate postoperative course, efficacy, and complication rates of Open Burch Colposuspension and Laparoscopic Burch Colposuspension techniques in stress or mixed urinary incontinence at a single training and research hospital for the last ten years in İstanbul, Turkey.

Methods: A retrospective cohort study was conducted in all Burch Colposuspension cases performed between January 2011 and May 2022 in the Department of Gynecology and Obstetrics of İstanbul Kanuni Sultan Süleyman Training and Resaerch Hospital. All patients' data were reviewed from the electronic medical records and analyzed who underwent Burch colposuspension surgery either with an open or laparoscopic approach. The primary outcome was a surgical success, whereas secondary outcomes were perioperative and postoperative data, including surgical type, operating time, duration of hospital stay, estimated blood loss, complications, subjective cure, and additional interventional procedure types.

Results: The demographic and clinical characteristics among the groups have no significant difference ($p > 0.05$). The major complication rate postoperatively was considerably higher in the OC group ($p<0.004$). There is a statistically significant difference in favor of LC in terms of pain score values (VAS) postoperatively at the 6th and 48th hours (6th hour, $p=0.036$, 48th hour, $p<0.0001$). There was no statistically significant difference between study groups regarding objective success (%15,5 and %16,9, respectively). Postoperatively, there was no statistically significant difference between groups regarding subjective cure rates (UDI-6 and IIQ-7).

Conclusions: Midurethral Sling procedures are the first-line treatment in SUI patients. However, their long-term effectiveness is similar to other SUI treatments and lower complication rates, so surgeons can prefer LC.

Keywords: Burch colposuspension, laparoscopy, urinary incontinence

INTRODUCTION

Stress urinary incontinence (SUI) is unintentional urinary leakage during strenuous work that increases intra-abdominal pressure, such as coughing, sneezing, or exertion without urethral sphincter weakness. SUI prevalence among women increases with aging and dramatically reduces the quality of women's lives.[1] Surgery is recommended for moderate/severe SUI cases if the conservative therapy has failed. Several surgery methods can be applied for SUI treatment; however, ongoing debates exist regarding the highest procedure effectiveness, cost-effectivity, and lowest morbidity. Burch colposuspension is one of those methods primarily described in 1961, which aims to support the ureterovesical junction.[2] The laparoscopic approach was performed in 1991 by Vancaille and Schuessler; similar to the conventional procedure, moreover has many potential advantages, including minimal blood loss, shortened hospitalization, speed recovery, and a better approach to the retropubic space.[3] In the 1990s, Burch colposuspension was accepted as a gold standard method for SUI, which later left in place its status to mid-urethral slings (MUS) in the 2000s due to the minimally invasive approach and having similar cure rates when compared with Burch colposuspension.[4] Although MUS gained popularity until then, the context of current safety concerns regarding using synthetic meshes for incontinence surgery has led governments such as Scotland (2014), Australia (2017), New Zealand (2017), and the UK (2018) to take precautions against further complications.

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Furthermore, the Food and Drug Administration (FDA) reclassified surgical mesh instrumentation from low risk to intermediate risk (Federal Register 2017), as well as European Parliament and the Council of the European Union suggested reclassifying mesh instrumentation from intermediate risk to high risk (Regulation (EU) 2017).[5,6] NICE guideline (NG123), published in April 2019, recommends colposuspension as a treatment option for SUI whether non-surgical management has failed.[7] Under those circumstances, as a treatment option for SUI patients, colposuspension procedures have flared up again. Our current study illustrates our surgical team's clinical experience with Burch colposuspension, either open or laparoscopic approach, in ten years for women having SUI.

METHODS

A retrospective cohort study was performed on 390 patients diagnosed with SUI or mixed urinary incontinence who underwent anti-incontinence surgery (urethropexy) between January 2011 to May 2022 in the Department of Obstetrics and Gynecology of İstanbul Kanuni Sultan Süleyman Training and Research Hospital. The study protocol was approved by the Bezmialem Vakıf University Ethics Committee (Date: 15.11.2022, Decision No: 2022/321), and registered at ClinicalTrials.gov (NCT05452811). All procedures were carried out under the ethical rules and the principles of the Declaration of Helsinki. Due to the character of our study, informed consent was not obtained from the patients included in the study.

An electronic medical database of the hospital was used to determine patients who carried out open (OC) or laparoscopic colposuspension surgery (LC) for SUI without sphincter weakness in the last ten years. The patient's preoperative evaluation comprises history, physical examination, complete blood count, urinalysis, and cough stress test (CST). Demographic charts, including age, parity, body mass index (BMI), menopausal status, hormonal replacement status, type of birth, incontinence type, concomitant pelvic organ prolapse type (descensus uteri, cystocele, rectocele or enterocele), and comorbidities were obtained from patients records. The perioperative data such as the surgical type (open or laparoscopic), operating time, duration of hospital stay, estimated blood loss, additional interventional procedure types, urinary retention after surgery (>100 ml residual volume on the first operative day), voiding dysfunction (prolonged indwelling catheter usage) and short-term postoperative minor and major complications like persistent SUI, surgical wound infection, urinary tract infections, bladder or bowel injury, blood transfusion, and vault infections were recorded. Besides, women having prolapse concomitant with stress urinary incontinence were assessed according to the Pelvic Organ Prolapse Quantification system.

Patients having SUI or mixed urinary incontinence were included for whom conservative therapy (Kegel's pelvic floor exercises, bladder training, electrical stimulation, or medication) failed, and a cough stress test had proved SUI. Also, patients with urethral hypermobility supported by a residual urinary volume of less than 100 ml were included. Exclusion criteria were as follows; history of SUI operation, intrinsic sphincter deficiency at SUI, urinary retention, neurogenic bladder, suspected malignancy, only urge incontinence, chronic cystitis, pelvic inflammatory diseases, urinary tract infection, anticoagulant medication, anti-psychiatric medicine consuming, coagulation disorders, physically and medically unsuitable for colposuspension surgery, pregnancy and loss to follow-up.

Determination of the type of urinary incontinence based on objective tests such as a positive cough stress test (at the supine position, patients requested to cough with a filled bladder of at least 300 ml of saline). Multichannel urodynamic studies (MUDs)were performed to differentiate mixed-type incontinence from SUI alone. Urinary retention is designated as bladder volume exceeding 100 ml after micturition.

Anti-incontinence surgery was performed either open or laparoscopic, depending on the operating team's choice. The same experienced surgical team carried out all the procedures. Among patients having mixed incontinence, surgery was performed for whom SUI was predominant.

The laparoscopic Burch colposuspension technique (transperitoneal approach) was performed with the same surgical steps as in the open procedure using No:2 Ethibond (Ethicon) curved needle. Extracorporeal knots were used to stabilize the sutures using an endoscopic knot pusher. Subsequently, we used methylene blue (up to 300 ml) to rule out bladder injury during the operation. Also, we performed cystoscopy in cases of suspicion of injury at the bladder or urethra or in cases having recurrent urinary tract infections or dysuria after the operation. A single dose of cefazolin (broad-spectrum cephalosporin) was administered 1 hour before surgery as antibiotic prophylaxis. The standard duration of postoperative catheterization was two days. The catheterization was extended in conditions with infection or intraoperative bladder perforation.

After removing the urinary catheter at 48th hours, we measured the residual urine volume (PVR). For diagnosis, the cut-off limit for PVR was established as 100 ml. We removed the urinary catheter and discharged the patients after two consecutive measurements of PVR less than 100 ml. If the PVR volume exceeds 100 ml, the patient received a permanent catheter for three days, then the PVR measurement was repeated as before.

A visual Analog Scale (VAS) was performed after the 6th and 48th hours of the procedure to evaluate postoperative pain. A validated 100 mm VAS scale was used for measuring patients' pain scores. The follow-up period of all patients was arranged with control visits on the 10th day and 1, 6, 12, 24 months postoperatively and annually after that. The clinical examination was conducted during control visits performing cough stress tests to assess an objective cure. The objective cure was a negative cough stress test after the procedure. In contrast, the subjective cure was analyzed by asking patients to fill out a validated Turkish version of the urinary distress inventory (UDI-6) and incontinence impact questionnaire (IIQ-7).

Data analysis was performed using SPSS v.21 (SPSS Inc., Chicago, IL, USA). Continuous variables were presented as mean, standard deviation, and nominal variables were expressed in numbers and percentages (%). For the comparison of continuous data between two independent groups, the t-test was used. The Chi-square and Fisher's exact tests were performed to compare categorical data. A p-value of <0.05 was considered to indicate statistical significance.

RESULTS

A total of 390 colposuspension patients were included in our study. While 52 of these patients had LC, 338 of them underwent OC. There was no significant difference among groups in terms of demographic and clinical characteristics (age, BMI, parity, smoking, chronic diseases, type of birth, type of incontinence, instrumental vaginal delivery, and menopause) (p>0.05) (Table 1 and 2).

The study showed a statistically significant difference between LC and OC operation times (p=0.042). The operational time was significantly shorter in the OC method in comparison with the LC approach (56.3 min versus 105.2 min). LC approach was associated with less blood loss than OC (70.5 ml and 143.7 ml, respectively). Despite similar preoperative hemoglobin levels before surgery, mean postoperative hemoglobin levels were significantly higher in the LC group compared with the OC approach, which reflects the difference in the amount of bleeding (12.2 g/dL vs. 10.38 g/dL, p<0.013). A statistically significant difference was found when the length of stay (LOS) in the hospital was compared (Table 3). This difference reduced hospital stays in the LC group (2.3 days vs. 2.7 days, respectively). When questioned during the postoperative first month at the outpatient clinic controls, the recovery time for daily activities was compared between the two groups. Resumption to regular activity is not significantly different (16.2 days vs. 26 days, p<0,069). No significant difference was found between the groups regarding residual urine volume measured in the preoperative and postoperative periods. Postoperative pain score values (VAS) at the 6th and 48th hours were compared between both groups, and statistically significant results were determined in favor of LC (6th hour, p=0.036, 48th hour, p<0.0001).

Table 1. Demographic parameters of patients

	Laparoscopic Burch n: 52		Open Burch n:338		P value
	mean	Standard deviation	mean	Standard deviation	
AGE	50.58	6.60	50.75	6.67	0.912
PARITY	3.54	1.41	3.67	1.49	0.609
BMI	25.96	2.73	25.91	2.64	0.855

Table 2. Preoperative data of patients

	Laparoscopic BURCH		Open BURCH		P value
	n: 52	%	n:338	%	
Smoking					0.451
Yes	16	30.8	95	28.1	
No	36	69.2	243	71.9	
Menopause status					0.769
Yes	38	75	188	55.6	
No	14	25	150	44.4	
Chronic disease					0.856
Not present	24	46.2	150	44.4	
Hypertension	14	26.9	94	27.8	
Diabetes Mellitus	5	9.6	38	11.2	
Comorbidity	9	17.3	56	16.6	
Type of birth					0.211
NSVD	39	75	255	75.4	
C/S	13	25	83	24.6	
Type of incontinence					0.514
Stress type incontinence	33	63.5	207	61.2	
Mix type incontinence	19	36.5	131	38.8	
Instrumental vaginal delivery/prolonged birth history					0.514
No	40	77	258	76.3	
Yes	12	23	80	23.7	

Table 3. Preoperative and postoperative results of the patients

	Laparoscopic BURCH n: 52		Open BURCH n:338		P value
	Mean	Standard deviation	Mean	Standard deviation	
Operation time (min)	105.29	8.19	56.36	7.26	0.042*
Estimated blood loss (ml)	70.57	20.81	143.73	49.93	<0.0001*
Pre-operative hemoglobin level (g/dL)	13.20	0.76	13.32	0.62	0.128
Post-operative hemoglobin level (g/dL)	12.28	0.75	10.39	1.15	0.013*
Duration of hospital stay (day)	2.35	1.03	2.70	0.59	0.027*
Recovery time to normal activity (day)	16.23	2.69	26.09	3.19	0.069
Pre-operative residual amount (ml)	6.64	8.44	6.42	8.33	0.908
Post-operative residual amount (ml)	6.06	6.59	10.52	26.98139	0.113
Post-operative 6th-hour pain score (VAS)	5.23	0.88	7.02	1.21	0.036*
Post-operative 48-the hour pain score (VAS)	2.85	0.78	6.15	1.43	<0.0001*
Pre-operative UDI-6 scores	9.48	3.15	9.55	3.61	0.016*
Post-operative sixth-month UDI-6 scores	0.60	0.66	0.81	0.71	0.981
Post-operative first-year UDI-6 scores	0.67	0.68	0.78	0.74	0.443
Pre-operative IIQ-7 scores	9.61	3.05	9.84	3.37	0.138
Post-operative sixth-month IIQ-7 scores	0.52	0.64	0.57	0.64	0.838
Post-operative first-year IIQ-7 scores	0.38	0.57	0.46	0.57	0.293

Concomitant surgeries performed during the LC group included hysterectomy (n: 40 [76.9%]), prolapse surgery (n: 10 [19.2%)]), posterior colporrhaphy/perineoplasty/Gardner cyst excision (n: 1 [1.9%)]) and myomectomy (n: 1 [1.9%)]. Moreover, open abdominal surgeries performed simultaneously with the Burch procedure included; hysterectomy (n: 255 [76.4%]), prolapse surgery (n: 74 [21.9%)]), posterior colporrhaphy/perineoplasty/Gardner cyst excision (n: 7 [2.1%)]) and myomectomy (n: 2 [0.6%)]. Objective and subjective cure rates, minor complication rates, and outcomes were not affected by the concomitant surgeries performed during Burch colposuspension in both groups (Table 4).

The postoperative major complication rate was considerably higher in the open surgery group (p<0.004). In the LC group, only three bladder injuries were seen (5,8%), while in the OC group 3 blood transfusions (0,9%), four bladder injuries (1,2%), one relaparotomy (0,9%), and one bowel injury (0,9%) were reported.

The success rates of the OC and LC groups were similar according to the presence of postoperative incontinence (15,5% and 16,9%, respectively). The preoperative and postoperative UDI-6 and IIQ-7 scores were compared between the groups reflecting subjective cure rates. There was no statistically significant difference between groups except preoperatively in UDI-6 and IIQ-7 scores. In the preoperative period, UDI-6 scores were higher in the OC group. Both OC and LC groups had improvement in UDI-6 and IIQ-7 scores postoperatively.

Table 4. Additional procedures during operations and post-operative complications

	Laparoscopic BURCH		Open BURCH		P value
	n: 52	%	n:338	%	
Concomitant procedures					0.576
Laparoscopic hysterectomy / abdominal hysterectomy/ adnexectomy	40	76.9	255	75.4	
Prolapse surgery (sacrocolpopexy, pectopexy, lateral suspension, Halban, Moscovic)	10	19.2	74	21.9	
Posterior colporrhaphy, perineoplasty, Gardner cyst excision	1	1.9	7	2.1	
Myomectomy	1	1.9	2	0.6	
Post-operative early complications (within the first week of surgery)					0.159
None	46	88.5	314	92.9	
Vault infection	1	1.9	5	1.5	
Wound infection	0	0	8	2.4	
Urinary tract infection	2	3.8	3	0.9	
Indwelling urinary catheterization	3	5.8	8	2.4	
Urinary retention	0	0	3	0.9	
Intra-operative complications					0.004*
None	49	94.2	329	97.3	
Blood transfusion	0	0	3	0.9	
Bladder injury	3	5.8	4	1.2	
Re-laparotomy (to open sutures)	0	0	1	0.9	
Bowel injury	0	0	1	0.9	
Post-operative late complications (>1 week after surgery)					0.555
None	49	94.2	318	94.1	
Vaut prolapse	1	1.9	5	1.5	
Cystocele	1	1.9	7	2.1	
Rectocele	1	1.9	5	1.5	
Enterocele	0	0	1	0.3	
Voiding dysfunction	0	0	2	0.6	
De novo urgency	1	1.9	0	0	
Post-operative incontinence					0.589
Yes	44	84.6	281	83.1	
No	8	15.4	57	16.9	

DISCUSSION

SUI hurts women's daily lives, which affects their routine activities and has a psychological burden. There are various surgical options for SUI that clinicians can choose according to their experience. Burch colposuspension is one method used as a standard gold method in patients with urethral hypermobility and left its place to MUS in time. Despite shorter operative times, relatively comfortable insertion technique, and higher success rates in the long-term of MUS, subversive mesh-related complications led clinicians to demand alternative meshless methods.[8] Another heated debate is continued regarding the governance of patients with SUI after unsatisfactory MUS operations.[9] Retropubic interventions (LC or OC) can be used as an optional surgical treatment in recurrent SUI patients following MUS operation with a cure rate of 84.2% objectively.[10] LC can be a preferable surgical treatment in patients having different comorbidities, which can be treated in the same session. A recent retrospective study compared Burch colposuspension with the MUS technique during a total laparoscopic hysterectomy procedure performed within the same session.[11] Seckin et al.[11] stated that the laparoscopic approach is a preferable treatment option due to its similar success rate, shorter surgical time, no mesh usage, and less blood loss than the open technique. LC seems to be a minimally invasive approach in patients with additional laparoscopy indications, which has similar cure rates with other SUI surgical managements.

Burch colposuspension operation has been a highly effective and long-lasting SUI procedure used successfully by surgeons for a long time.[12] The laparoscopic approach gained more popularity for its advantages, such as shorter hospital stays, better aesthetic results, improved visualization of retrius space, lesser blood loss during operations, and less usage of analgesics postoperatively.[13-15] Additionally, a current Cochrane review about open retropubic colposuspension, including fifty-five studies with 5417 women involved, suggests OC is an effective treatment option for SUI with continence rates of approximately 85%-90% in the first year, furthermore 80% continence rate in 5 years period.[3] The literature comprises two randomized control studies (RCT) comparing open versus laparoscopic colposuspension techniques in SUI patients. Although longer operation times were observed laparoscopically, postoperative pain and blood loss during the operation were less.[16] In addition, at five years of follow-up, anatomical success rates and subjective evaluation between OC and LC groups were similar. We observed the same results in which the length of the LC procedure was statistically longer. In contrast, blood loss, postoperative hemoglobin level change, duration at the hospital, and postoperative VAS scores were lower than the OC group.

Another RCT supporting these findings, which compares colposuspension methods, reported that objective and subjective cure rates were similar when both procedures were performed by skilled surgeons.[17] As we look at our data, similar to the literature, the objective cure rates between OC and LC were similar for two years (LC, 84.6%; OC, 83%, respectively). In the subjective cure rates in our study, similar results have been found, such as 76.2% in LC and 75.5% in the OC group. Subjective cure rates of our study support the Cochrane review performed by Freites et al.[18] where evidence suggests that the short-term subjective cure rates of the LC and OC groups were similar. The literature is scarce, and there needs to be more evidence to compare OC and LC to determine whether both have any advantage over each other regarding subjective cure rates and quality of life.[3] Most published studies compared BC with other surgical procedures for SUI, showing diverse conclusions regarding subjective cure rates on the long-term follow-up period.[11,12,17,19] A systematic review and meta-analysis comparing data from different SUI procedures showed that in long-term follow-up, MUS and BC have equal subjective continence rates.[20] We found similar postoperative subjective cure rates at the first month, the sixth month, and 1st year, similar to Fusco et al.[20] However, preoperative UDI-6 scores were higher in the open BC group. This result might be due to the difference in the number of samples among groups.

In our study, although the rates of minor complications were similar between the LC and OC groups, the major complication rates were higher in the OC groups ($p<0.004$). Complication rates in the literature were similar in both groups. Bladder injuries were slightly higher in the LK group.[15] In one review, there were 21 (4.14%) bladder injuries in the laparoscopy group of 507 cases, while in another study, 10 (1.92%) of 521 open surgery cases had bladder injuries.[15] In our study, we had 3 (5.77%) bladder injuries in the laparoscopy group and 4 (1.18%) in the open surgery group, and we had similar results to the literature. In the same review, although perioperative complications, including major complications, were rare, vascular injury, one of the major complications, was almost the same in both groups. In our study, the open surgery group had higher rates of bladder or bowel injuries, relaparotomy (in one case), and massive blood transfusion. There was no difference between the study groups in terms of major complications such as bowel injury and relaparotomy among our statistically different results in the studies in the literature. We attributed this to the fact that the number of patients who underwent open surgery from the patient groups we included in the study was higher than the number of patients who underwent closed surgery. Long-term prospective multicenter and multi-participant studies are needed to clarify this issue.

A Cochrane review performed in 2017 reported that after open colposuspension surgeries, pelvic organ prolapse is more likely compared to MUS or anterior colporrhaphy procedures.[3] We performed Burch colposuspension concomitant with prolapse surgeries, but we did not study the postoperative pelvic organ prolapse rates between groups which is one of our study's limitations. Another limitation of our study is that it was designed retrospectively, and we observed patients and the outcomes of the surgeries for two years. The patient numbers in each group were varied, and we did not use validated questionnaires for SUI outcomes. However, the strengths of our study include an experienced surgical team with the same operators performing the surgeries, a large sample size, and similar demographic characteristics between the two groups.

CONCLUSION

The literature concludes that traditional minimal invasive slings (transobturatuar or mid-urethral) have better cure rates than Burch colposuspension.[3,21] Although the superiority of sling procedures, adverse event rates are higher such as urinary retention and voiding dysfunction. In contrast, laparoscopic Burch colposuspension has the same effect as the open technique.[3] This study supports the conclusions about the Burch colposuspension procedure in the literature, where both open and laparoscopic techniques show similar cure rates. Conversely, in the literature, major complication rates (bladder or bowel injury, relaparotomy, blood transfusion) were higher in the open colposuspension group. Those results show that if the patient has concomitant pathologies that can be done laparoscopically, the surgeon should choose the laparoscopic approach based on their experience. There is no consensus on surgery selection after failed MUS surgeries which shows that researchers should focus on this issue. Most studies in the literature comparing open or laparoscopic Burch colposuspension were designed retrospectively; moreover, there need to be randomized controlled prospective studies.

SUI is a common health problem and a burden to the healthcare system, especially in premenopausal and postmenopausal women. Its incidence increases with age, and surgery is the optimal option for the treatment. There are different surgical options for SUI. However, the appropriate patient selection, correct indication, and surgical team experience will affect the treatment efficacy. Additionally, recurrent or persistent SUI case management after failed MUS surgery remains unclear, whereas Burch colposuspension seems an optional complementary surgical treatment.[22] Surgeons can prefer Burch colposuspension over other SUI treatments, where concomitant abdominal surgeries are planned, a vaginal approach is limited, or mesh usage is contraindicated.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of the Bezmialem Vakıf University Ethics Committee (Date: 15.11.2022, Decision No: 2022/321).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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